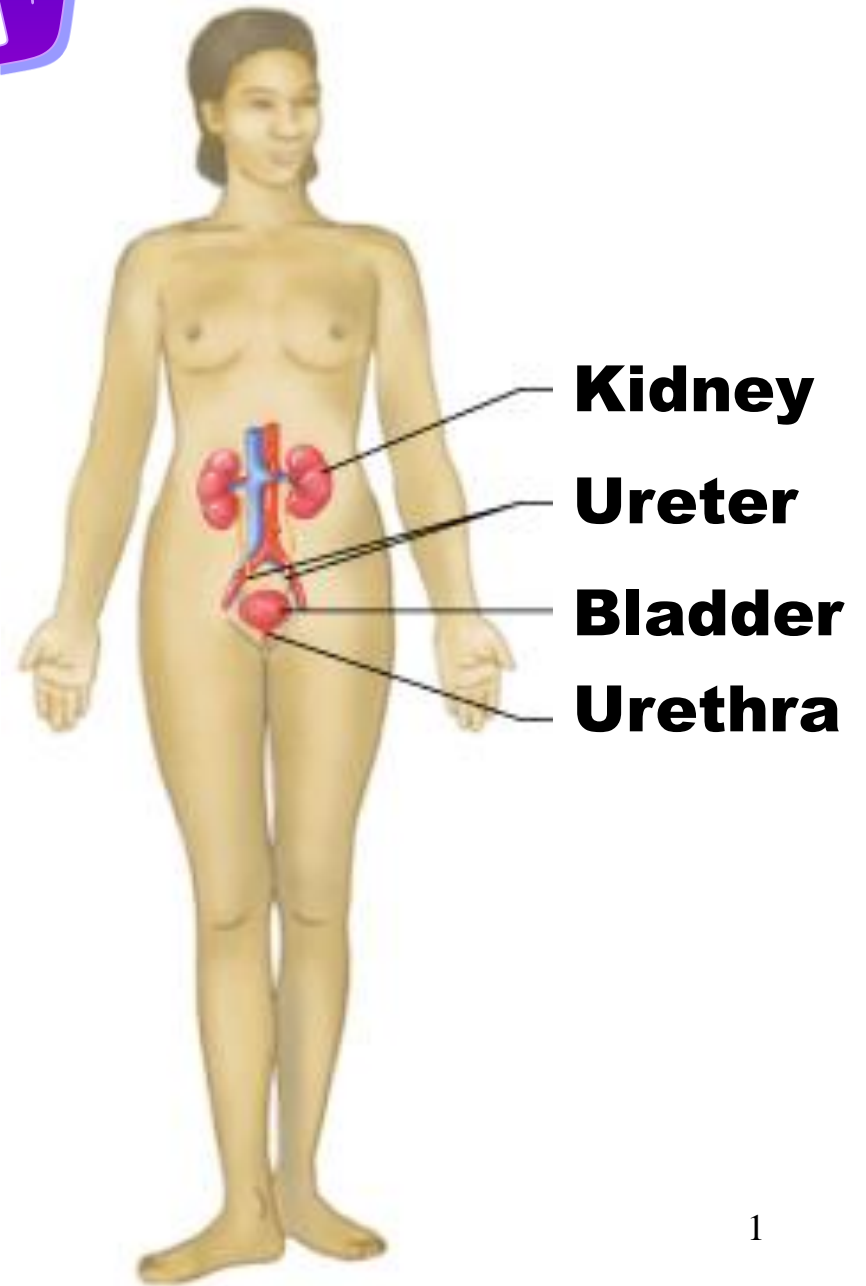


The Urinary System



Objectives

After studying this chapter, you will be able to:

- **Name the parts of the urinary system and discuss the function of each part**
- **Define combining forms used in building words that relate to the urinary system**
- **Identify the meaning of related abbreviations**
- **Name the common diagnoses, clinical procedures, and laboratory tests used in treating disorders of the urinary system**

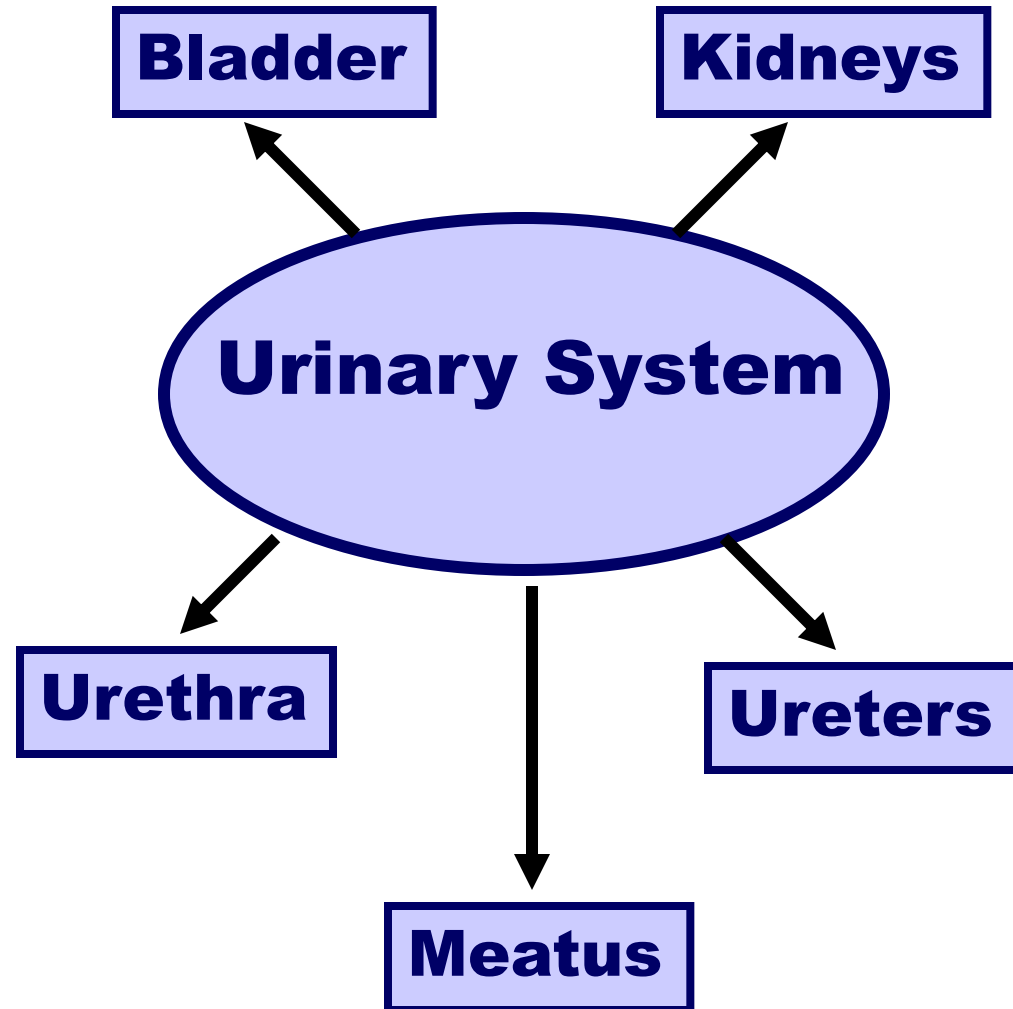
Objectives cont'd

- **List and define the major pathological conditions of the urinary system**
- **Explain the meaning of surgical terms related to the urinary system**
- **Recognize common pharmacological agents used in treating the urinary system**

Structure and Function

The Urinary System

- **Also called the excretory system**
- **Maintains water balance**
- **Removes waste products from the blood by excreting them in the urine**



Structure and Function

Kidneys

The kidneys are bean-shaped organs located in the retroperitoneal portion of the abdominal cavity on either side of the vertebral column.

Two Primary Functions

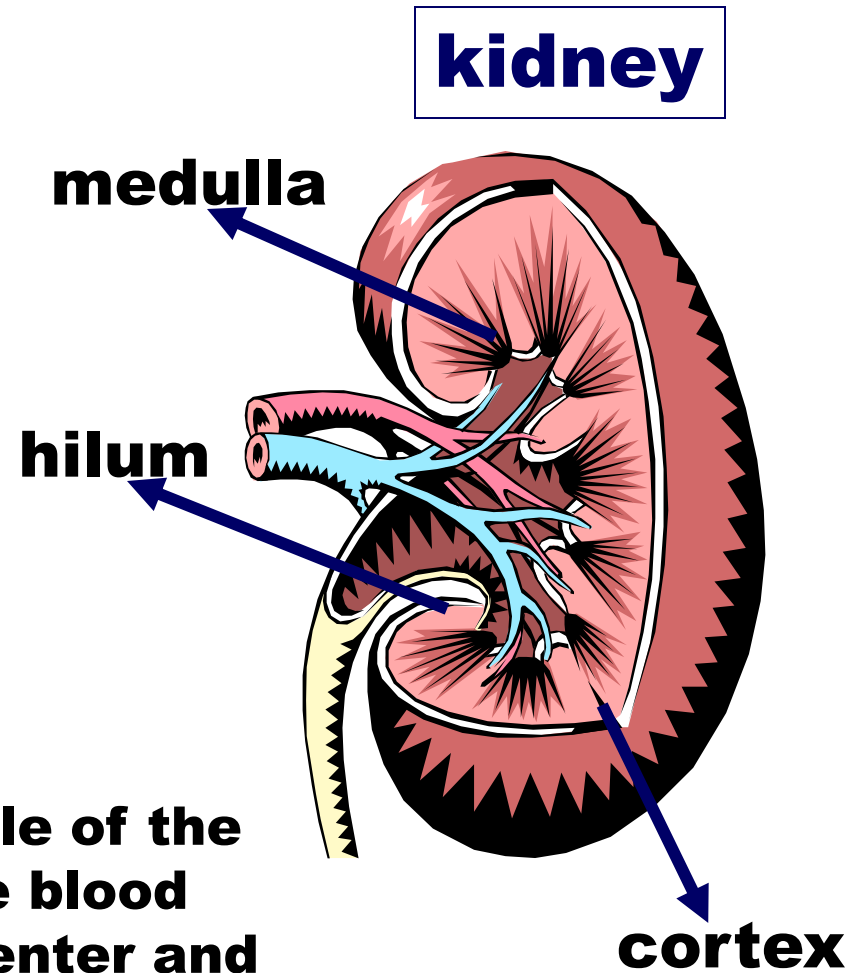
- To form urine for excretion**
- To retain essential substances the body needs in the process called reabsorption**

Structure and Function

Kidneys filter about 1700 liters of blood daily in the average adult.

Parts of the kidneys

- **Cortex**
 - outer protective portion
- **Medulla**
 - inner soft portion
- **Hilum**
 - a depression located in the middle of the concave side of the kidney where blood vessels, nerves, and the ureters enter and exit the kidneys



Structure and Function

Urine is produced by filtration of:

- water
- salts
- sugar
- urea
- creatinine
- uric acid

Each kidney contains more than 1 million nephrons which are the functional units of the kidneys.

Blood Flow through the Kidneys

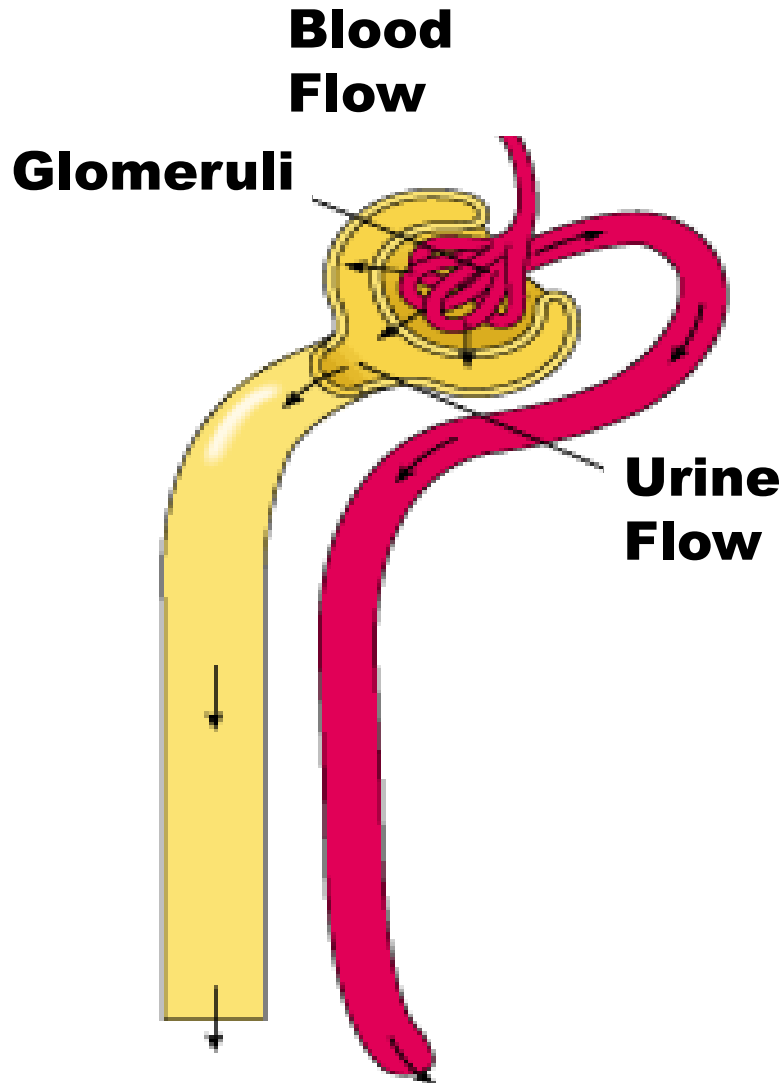
Blood enters through the renal artery → arterioles →

Each arteriole leads to a nephron → renal corpuscle

(which has a group of capillaries called the glomerulus)

The glomerulus filters fluid from the blood, and is the first place where urine is formed in the kidneys.

Structure and Function



- **Blood flows through the glomerulus at a constant rate.**

- **Each glomerulus is surrounded by a capsule known as **Bowman's capsule**.**

- **Blood then passes into the **renal tubules** where some substances are **reabsorbed** and the remaining become urine.**

Structure and Function

Flow of Urine

glomerulus



renal tubules



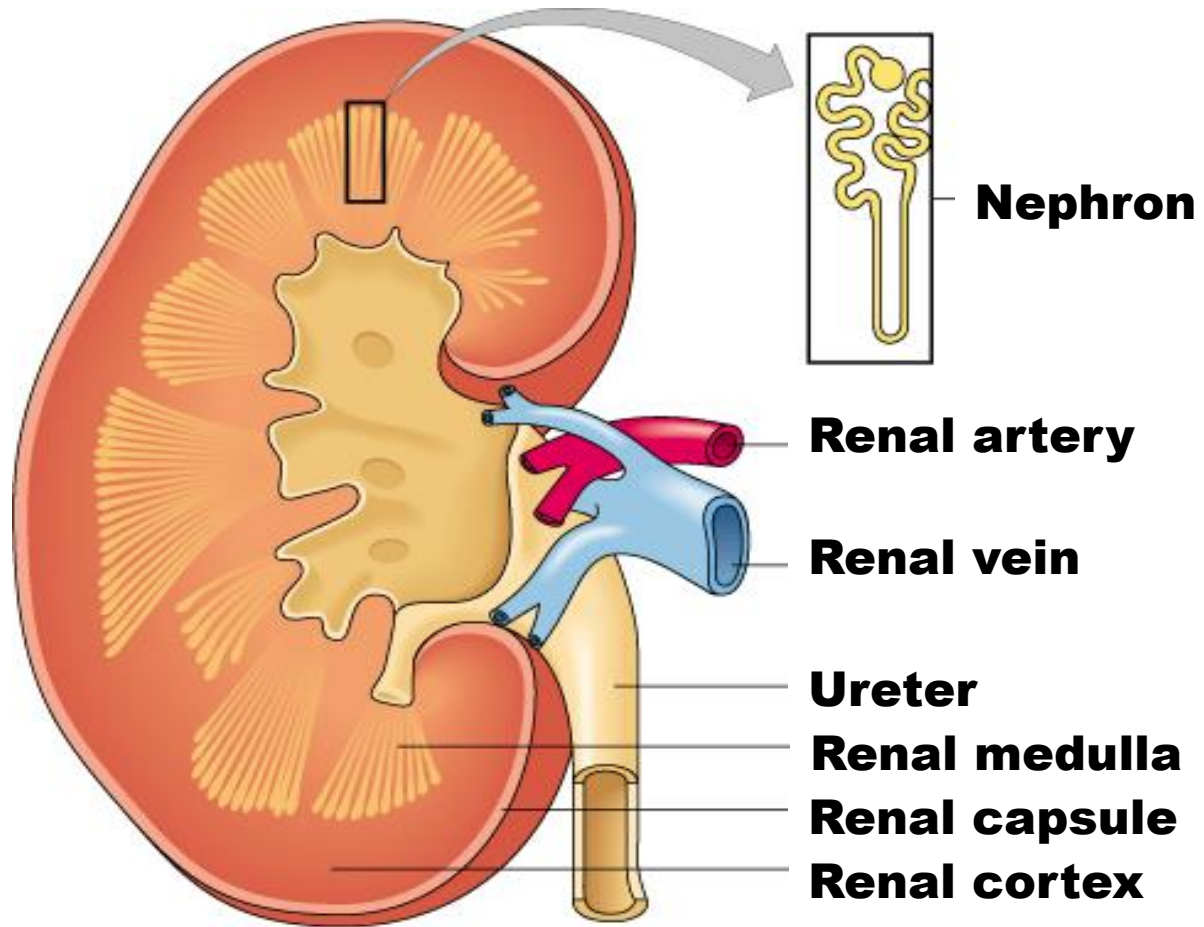
renal pelvis



renal calices



ureters



Filtered blood exits the kidneys via the renal vein.

The renal tubules carry urine to ducts in the renal cortex.

Structure and Function

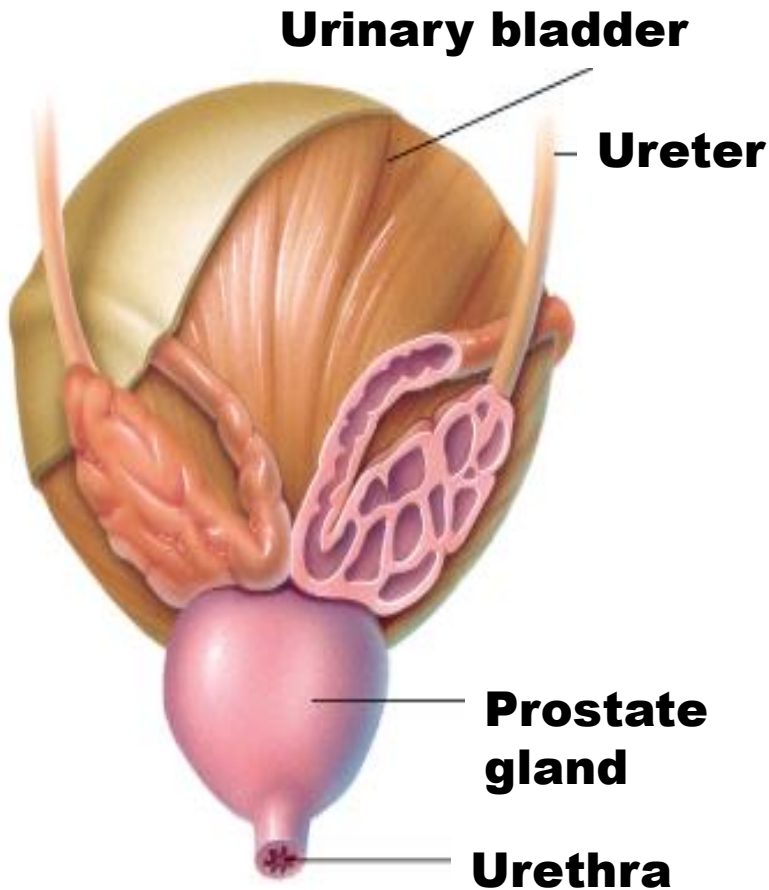
Ureters

- **A tube approximately 6 to 7 inches long attached to each kidney**
- **Made up of three layers of tissue**
 - **smooth muscle**
 - **fibrous tissue**
 - **mucous layer**

Peristalsis, a rhythmic contraction of the ureter smooth muscle which helps to move the urine into the bladder.

Structure and Function

Urinary Bladder



- **Hollow, muscular organ that stores urine**
- **Sphincter muscles hold the urine in place**
- **Holds 300 to 400 milliliters of urine before emptying**
- **Walls contain epithelial tissue that stretch to allow the bladder to hold twice its capacity**
- **The trigone is a triangular area at the base of the bladder where the ureters enter and the urethra exits**

Structure and Function

Urethra

A tube of smooth muscle with a mucous lining that carries urine from the bladder to the outside of the body.

Female Urethra

- **Approximately 1.5 inches long**
- **Opens through the meatus**

Excreting urine is called voiding or micturition

Male Urethra

- **Approximately 8 inches long**
- **Passes through three different regions:**
 - **prostate gland**
 - **membranous portion**
 - **penis**

Combining Forms and Abbreviations

Combining Forms

Meaning

cali(o)



calix

cyst(o)



bladder

glomerul(o)



glomerulus

meato



meatus

nephr(o)



kidney

pyel(o)



renal pelvis

ren(o)



kidney

Combining Forms and Abbreviations

Combining Forms

Meaning

trigon(o)

trigone

urin(o)

urine

ureter(o)

ureter

urethr(o)

urethra

vesic(o)

bladder

Combining Forms and Abbreviations

Abbreviation

Meaning

ADH	→	antidiuretic hormone
A/G	→	albumin/globulin
AGN	→	acute glomerulonephritis
ARF	→	acute renal failure
ATN	→	acute tubular nephrosis
BNO	→	bladder neck obstruction
BUN	→	blood urea nitrogen

Combining Forms and Abbreviations

Abbreviation

Meaning

CAPD	continuous ambulatory peritoneal dialysis
Cath	catheter
Cl	chlorine
CRF	chronic renal failure
cysto	cystoscopy
ESRD	end-stage renal disease
ESWL	extracorporeal shock wave lithotripsy

Combining Forms and Abbreviations

Abbreviation

Meaning

HD	→	hemodialysis
IVP	→	intravenous pyelogram
K+	→	potassium
KUB	→	kidney, ureter, bladder
Na+	→	sodium
pH	→	power of hydrogen concentration
PKU	→	phenylketonuria

Combining Forms and Abbreviations

Abbreviation

Meaning

RP	retrograde pyelogram
SG	specific gravity
UA	urinalysis
UTI	urinary tract infection
VCU	voiding cystourethrogram

Diagnostic, Procedural and Laboratory Terms

Urologists are physicians who specialize in disorders of the male and female urinary tracts, and the male reproductive system.

Common Tests

Urinalysis

- Examination of the urine for its physical and chemical properties
- Obtained from clients who fill a specimen container or by urinary catheterization

Characteristics of Urine

- Normal urine is straw-colored and clear
- Normal specific gravity (SG) range is from 4.5 to 8.0
- Specific gravity measures the amount of wastes, minerals and solids present in the urine

Diagnostic, Procedural and Laboratory Terms

Glucose

Casts

Albumin

Blood

**Abnormal Findings
in the Urine**

Ketones

Phenylketones (PKU)

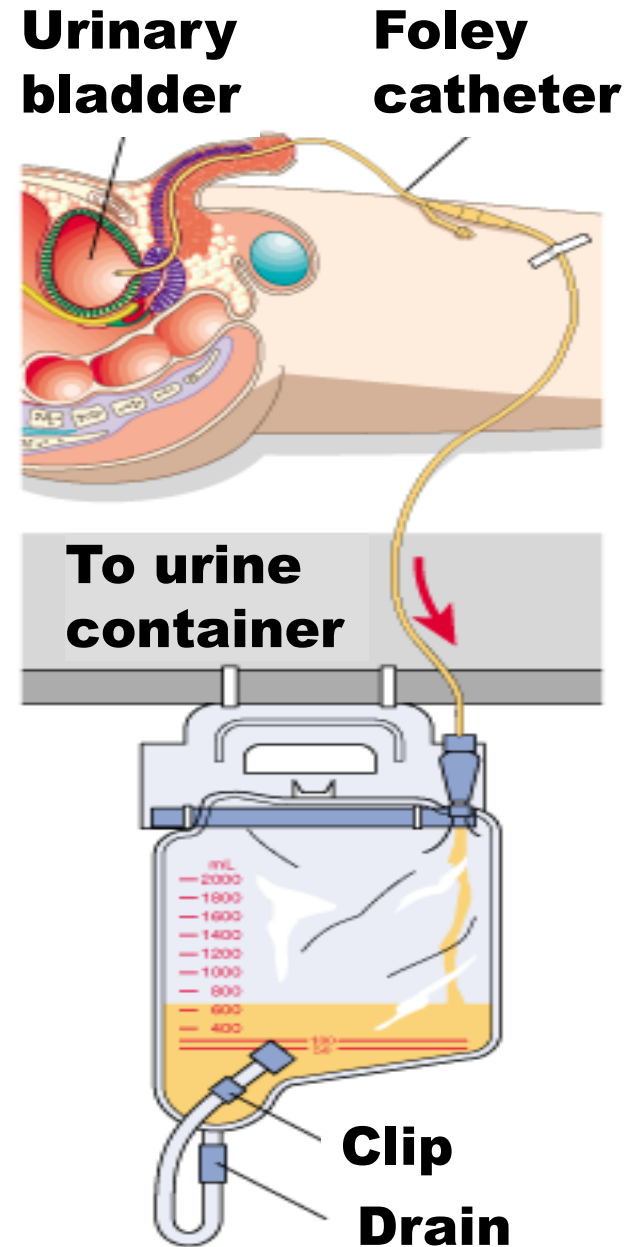
Bilirubin

Diagnostic, Procedural and Laboratory Terms

Types of Catheters

Foley catheter

- **An indwelling catheter held in place by an inflated balloon in the bladder**

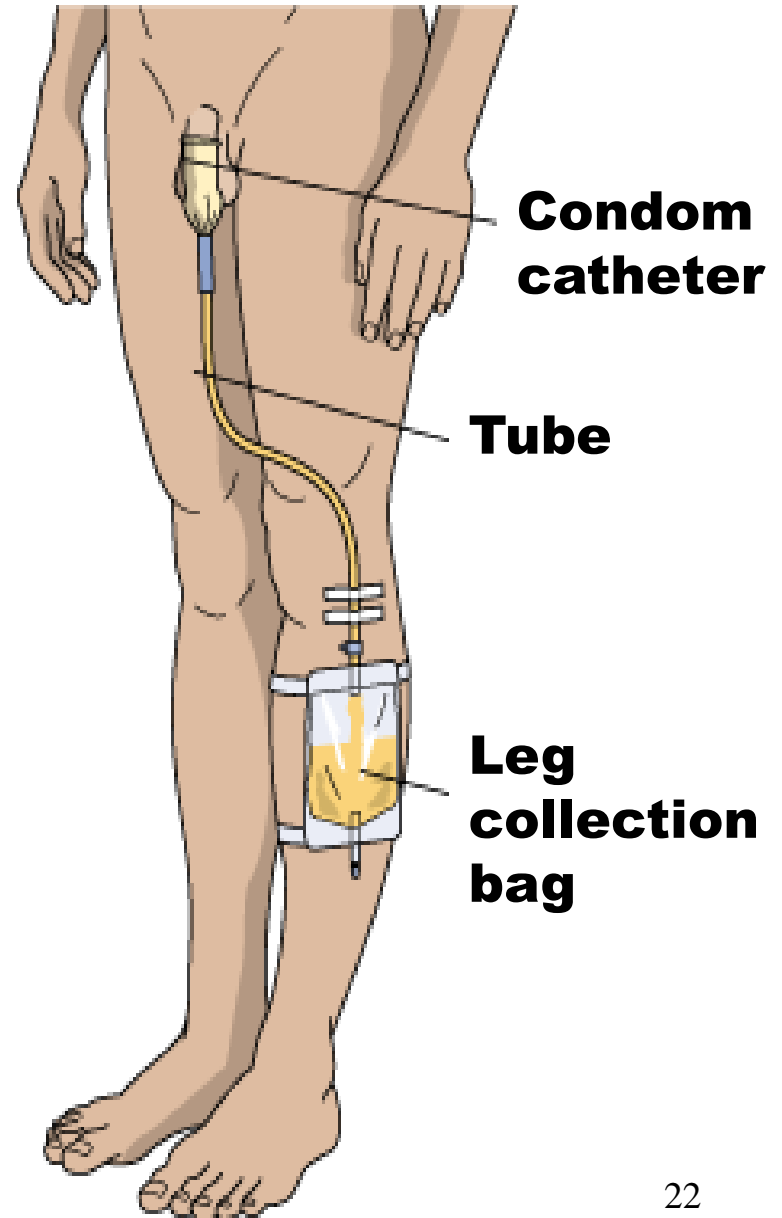


Diagnostic, Procedural and Laboratory Terms

Types of Catheters

Condom catheter

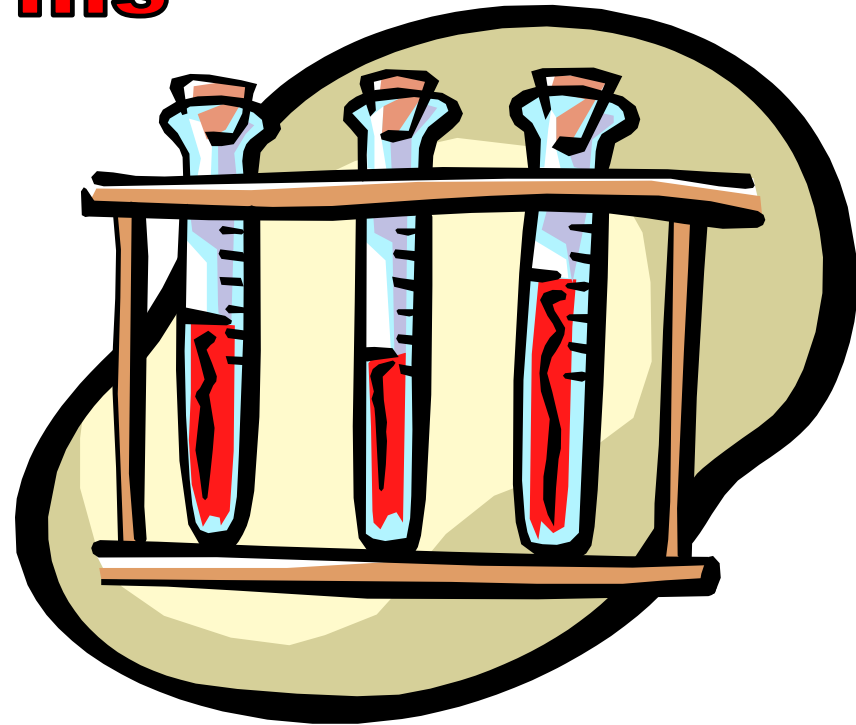
- **External catheter consisting of a rubber sheath placed over the penis**



Diagnostic, Procedural and Laboratory Terms

Blood Tests

- Blood Urea Nitrogen (BUN)
- Creatinine Clearance Test



The presence of high amounts of **urea** or **creatinine** in the blood shows that the kidney is not properly filtering these substances.

Diagnostic, Procedural and Laboratory Terms

Imaging Tests

•Cystoscopy

-tubular instrument used to examine the bladder

•Intravenous Pyelogram

-x-rays of the urinary tract after a contrast medium is injected into the bloodstream

•KUB

-x-ray of three parts of the urinary tract (kidney, ureter, and bladder)

•Renal Scan

-radioactive imaging used to diagnose kidney disorders



Diagnostic, Procedural and Laboratory Terms

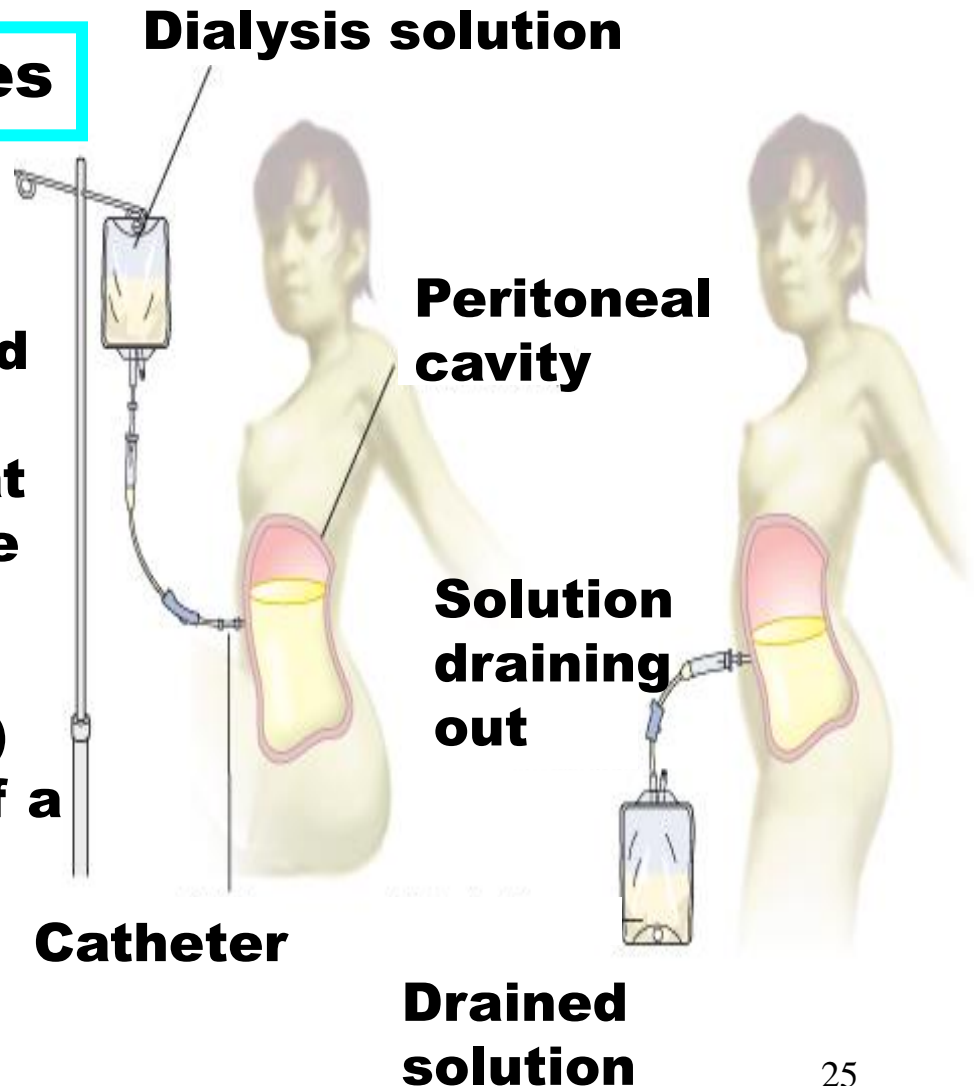
Urinary Tract Procedures

Dialysis

• Hemodialysis

-the process of filtering blood outside the body in an artificial kidney machine that returns the blood back to the body after filtering.

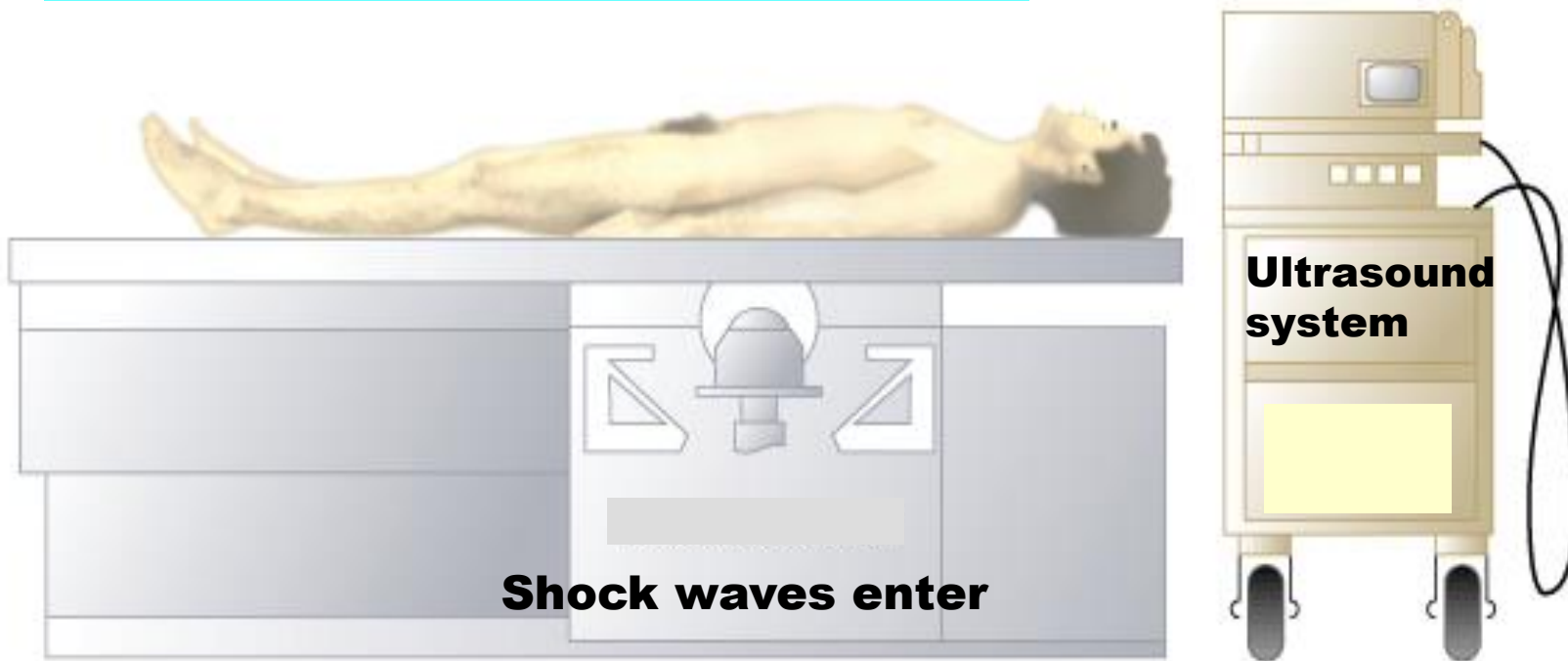
Peritoneal dialysis (pictured)
-the insertion and removal of a dialysis solution into the peritoneal cavity.



Diagnostic, Procedural and Laboratory Terms

Extracorporeal Shock Wave Lithotripsy (ESWL)

-the breaking up of urinary stones by using shock waves from outside the body



Pathological Terms

Urinary Tract Infection

Glomerulonephritis

Nephritis

**Inflammatory
&
Infectious Disorders**

Nephrosis

Hydronephrosis

Polycystic kidney disease

Nephroblastoma

Cystitis

Pathological Terms

Terms Used to Describe Difficulties in Urination

anuresis

- **No urinary output**

dysuria

- **Painful urination**

enuresis

- **Lack of bladder control**

polyuria

- **Excessive urination**

incontinence

- **Involuntary discharge of urine or feces**

oliguria

- **Scanty urination**

Surgical Terms

Parts of the urinary system may be surgically removed

- **Nephrectomy**- removal of a kidney
- **Ureterectomy**- removal of a ureter
- **Cystectomy**- removal of the bladder



Surgical repair procedures

- **Pyeloplasty**- repair of the renal pelvis
- **Cystoplasty**- repair of the bladder
- **Urethroplasty**- repair of the urethra

A urostomy is the creation of an artificial opening in the abdomen through which urine exits the body.

Surgical Terms

Other Surgical Procedures

Nephrolysis

- Removal of an adhesion in the kidney

Nephrolithotomy

- Removal of a kidney stone

Nephropexy

- Surgical fixation of the kidney

Nephrorrhaphy

- Suturing of a damaged kidney



Pharmacological Terms

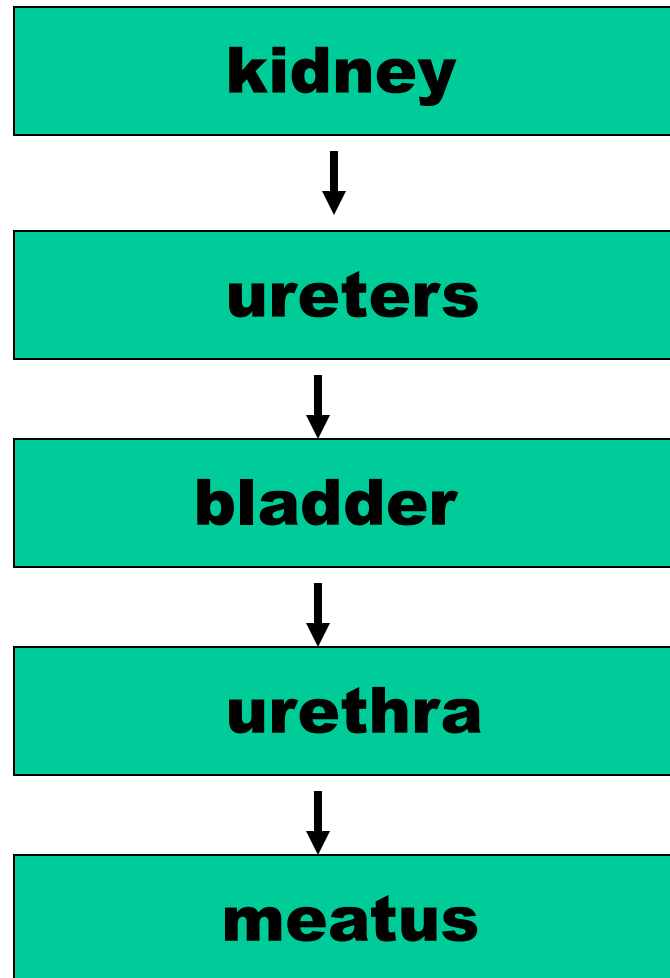
Medications used for urinary conditions assist to:

- **Relieve Pain (analgesic)**
- **Relieve Spasms (antispasmodic)**
- **Inhibit the growth of microorganisms (antibiotic)**
- **Increase urine output (diuretic)**
- **Decrease urine output (antidiuretic)**



Apply Your Knowledge

Complete the following Urinary System flowchart by naming the structures in descending order.



Apply Your Knowledge

Following a severe injury, Mr. Hudson is told by his urologist that he will need a surgical procedure to allow urine to exit the body through an opening in the abdomen.

Which of the following procedures will Mr. Hudson have performed?

A. urethrotomy

B. ureterectomy

C. urostomy

Answer: C. urostomy

Apply Your Knowledge

Susan was diagnosed with a bladder infection and given medication to treat the infection but she did not take it. Failure to treat a bladder infection may lead to which of the following?

A. kidney infection

B. cystitis

C. bladder cancer

Answer: A. kidney infection

Apply Your Knowledge

If an individual were to have a drastic drop in blood pressure below normal, which of the following would you expect, based on what you have learned about the renal system?



- A. increase in urine production**
- B. decrease in urine production**
- C. no change in urine production**

Answer: B. decrease in urine production